

WHAT IS CLAIMED IS:

1. An optical amplifier comprising:
 - an input power detecting unit that detects an input power of an optical signal;
 - 5 an output power detecting unit that detects an output power of the optical signal;
 - an optical amplifying unit that amplifies the optical signal;
 - a change factor detecting unit that detects a factor that causes a gain of the optical amplifying unit to change; and
 - 10 a control unit that provides a control, based on the input power, the output power, and the factor, so that the gain of the optical amplifying unit is a predetermined value.
2. The optical amplifier according to claim 1, wherein
 - 15 the change factor detecting unit detects a value of a factor that depends upon the input power of the optical signal, and
 - the control unit uses a result of addition of the value of the factor and the input power to provide the control.
- 20 3. The optical amplifier according to claim 1, wherein
 - the change factor detecting unit detects a value of a factor that depends upon a temperature of the optical amplifying unit, and
 - the control unit uses a result of addition of the value of the factor and the input power to provide the control.

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4. The optical amplifier according to claim 1, wherein
the change factor detecting unit detects a value of a factor that
depends upon both the input power of the optical signal and a
temperature of the optical amplifying unit, and
- 5 the control unit uses a result of addition of the value of the
factor and the input power to provide the control.
5. The optical amplifier according to claim 1, wherein
the change factor detecting unit detects a value of a factor that
10 depends upon the output power of the optical signal, and
the control unit uses a result of subtraction of the value of the
factor from the output power to provide the control.
6. The optical amplifier according to claim 1, wherein
15 the change factor detecting unit detects a value of a factor that
depends upon a temperature of the optical amplifying unit, and
the control unit uses a result of subtraction of the value of the
factor from the output power to provide the control.
- 20 7. The optical amplifier according to claim 1, wherein
the change factor detecting unit detects a value of a factor that
depends upon both the output power of the optical signal and a
temperature of the optical amplifying unit, and
the control unit uses a result of subtraction of the value of the
25 factor from the output power to provide the control.

8. The optical amplifier according to claim 1, wherein the optical amplifying unit includes an excitation laser diode, and
the control unit controls the excitation laser diode to provide the
5 control.
9. A control method for an optical amplifier, comprising:
detecting an input power of an optical signal;
detecting an output power of the optical signal;
10 amplifying the optical signal;
detecting a factor that causes a gain of the optical amplifying unit to change; and
providing a control, based on the input power, the output power, and the factor, so that the gain of the optical amplifying unit becomes
15 constant.
10. The control method according to claim 9, wherein
the detecting the factor includes detecting a value of a factor that depends upon the input power of the optical signal, and
20 the providing the control includes using a result of addition of the value of the factor and the input power to provide the control.
11. The control method according to claim 9, wherein
the detecting the factor includes detecting a value of a factor
25 that depends upon a temperature of an optical amplifying unit that

amplifies the optical signal, and

the providing the control includes using a result of addition of the value of the factor and the input power to provide the control.

5 12. The control method according to claim 9, wherein
the detecting the factor includes detecting a value of a factor that depends upon the input power of the optical signal and a temperature of an optical amplifying unit that amplifies the optical signal, and

10 the providing the control includes using a result of addition of the value of the factor and the input power to provide the control.

13. The control method according to claim 9, wherein
the detecting the factor includes detecting a value of a factor
15 that depends upon the output power of the optical signal, and
the providing the control includes using a result of subtraction of the value of the factor from the output power to provide the control.

14. The control method according to claim 9, wherein
20 the detecting the factor includes detecting a value of a factor that depends upon a temperature of an optical amplifying unit that amplifies the optical signal, and
the providing the control includes using a result of subtraction of the value of the factor from the output power to provide the control.

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15. The control method according to claim 9, wherein
the detecting the factor includes detecting a value of a factor
that depends upon the output power of the optical signal and a
temperature of an optical amplifying unit that amplifies the optical signal,

5 and

the providing the control includes using a result of subtraction of
the value of the factor from the output power to provide the control.

16. The control method according to claim 9, wherein the providing
10 control includes controlling an excitation laser diode in an optical
amplifying unit that amplifies the optical signal.